



## NH Department of Resources & Economic Development Division of Forests & Lands Forest Health Program

### Annual Newsletter 2016

Forest Tent Caterpillar  
Drought  
Gypsy Moth  
Southern Pine Beetle

172 Pembroke Rd  
Concord NH 03301  
603-464-3016



### IN THIS ISSUE:

<b>FIELD SURVEYS: HWA, EHS, RPS, SPB, SBW</b>	<b>Page 1</b>
<b>AERIAL SURVEY HIGHLIGHTS</b>	<b>Page 4</b>
<b>BUTTERNUT UPDATE</b>	<b>Page 6</b>
<b>EAB UPDATE</b>	<b>Page 7</b>
<b>FEATURE ARTICLE: Gypsy Moth Again</b>	<b>Page 10</b>
<b>FEATURE CREATURE: Southern Pine Beetle</b>	<b>Page 12</b>
<b>OFFICE NOTES</b>	<b>Page 15</b>

*Click on the [HYPERLINKS](#) throughout for more information on topics*

## FIELD SURVEYS

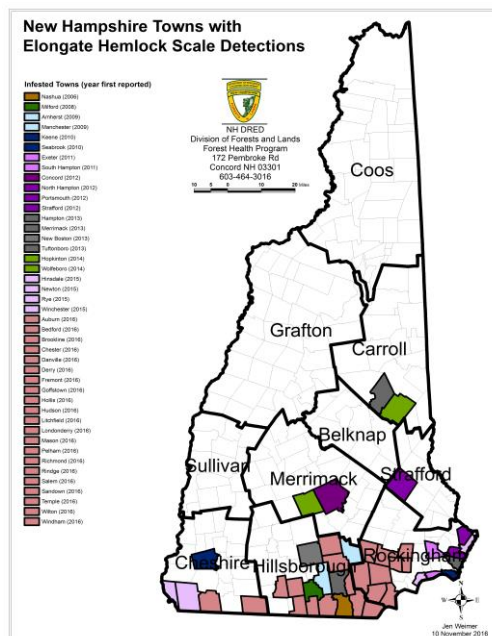
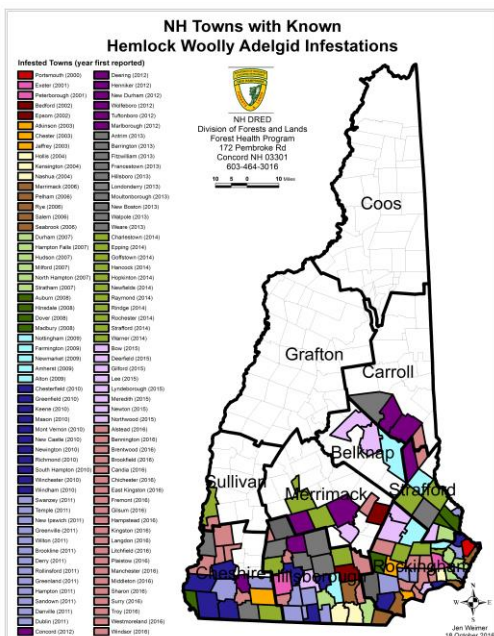
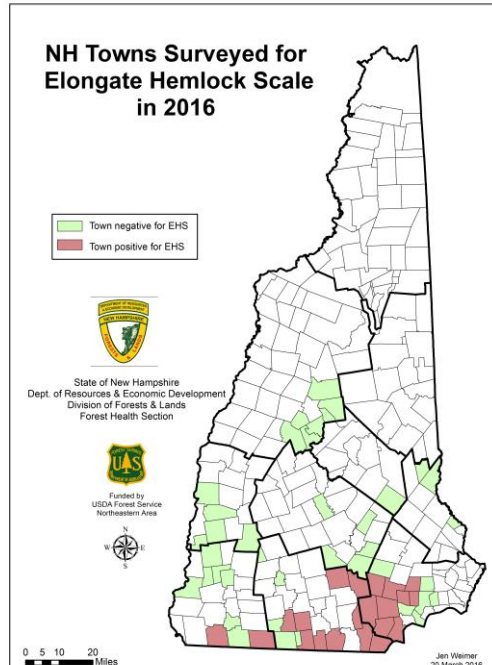
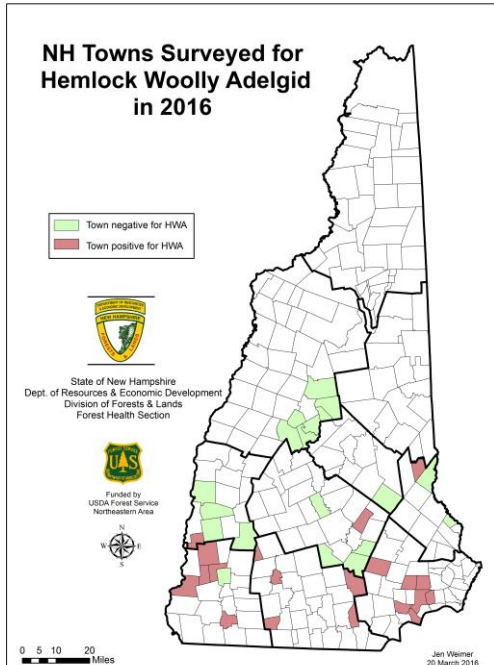
By: Jen Weimer

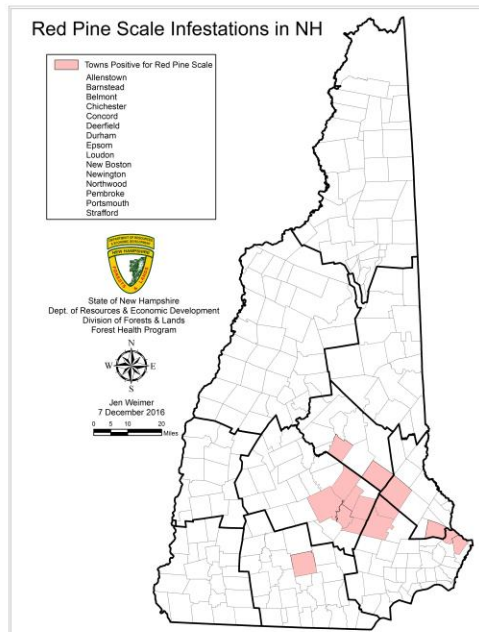
### Hemlock Woolly Adelgid and Elongate Hemlock Scale

Hemlock Woolly Adelgid (HWA) surveys for 2016 were done in high risk areas of southern New Hampshire where HWA infestations had not yet been detected and 7 towns in Grafton County that border the northernmost infested area. Towns surveyed included Acworth, Alexandria, Allenstown, Alstead, Ashland, Barnstead, Bennington, Boscawen, Brentwood, Bridgewater, Bristol, Campton, Candia, Chichester, Claremont, Dunbarton, East Kingston, Fremont, Gilsum, Hampstead, Hebron, Holderness, Hooksett, Kingston, Langdon, Litchfield, Manchester, Middleton, Milton, Plaistow, Sharon, Somersworth, Sullivan, Surry, Troy, Unity, Washington, Westmoreland, and Windsor. Infestations were found in Alstead, Bennington, Brentwood, Candia, Chichester, East Kingston, Fremont, Gilsum, Hampstead, Kingston, Langdon, Litchfield, Manchester, Middleton, Plaistow, Sharon, Surry, Troy, Westmoreland, and Windsor.

Elongate Hemlock Scale surveys for 2016 were done in conjunction with HWA surveys and in southern towns abutting towns with known infestations. Towns surveyed included Acworth, Alexandria, Allenstown, Alstead, Ashland, Auburn, Barnstead, Bennington, Boscawen, Brentwood, Bridgewater, Bristol, Brookline, Campton, Candia, Chester, Chichester, Claremont, Danville, Derry, Dunbarton, East Kingston, Fitzwilliam,

Fremont, Gilsom, Goffstown, Greenville, Hampstead, Hebron, Holderness, Hollis, Hooksett, Hudson, Kingston, Langdon, Litchfield, Londonderry, Manchester, Mason, Middleton, Milton, New Ipswich, Pelham, Plaistow, Richmond, Rindge, Salem, Sandown, Sharon, Somersworth, Sullivan, Surry, Temple, Troy, Unity, Washington, Westmoreland, Wilton, Windham, and Windsor. Infestations were found in Auburn, Brookline, Chester, Danville, Derry, Fremont, Goffstown, Hollis, Hudson, Litchfield, Londonderry, Mason, Pelham, Richmond, Rindge, Salem, Sandown, Temple, Wilton, and Windham. An infestation in Bedford was also reported by a homeowner.





## Red Pine Scale

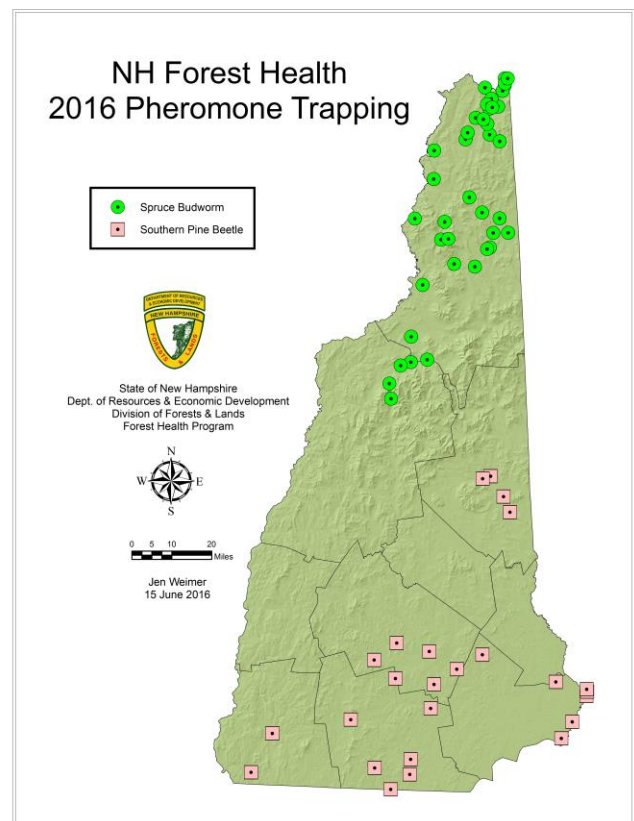
Red Pine Scale surveys for 2016 were conducted on high risk state lands and several towns in Grafton County along the Connecticut River in response to the infestations found in Rutland and Orange Counties of Vermont. State lands surveyed were Litchfield State Forest, Little Pine River State Forest, Black Mountain State Forest, and Merrimack River State Forest. Private lands were also surveyed with red pine in the towns of Hanover, Lyme, Orford, Piermont, and Haverhill. No new infestations were found during these surveys. New infestations were found in Durham at Adams Point Wildlife Management Area during other surveys and recently found in Belmont by a forester. In addition a report of dying trees in New Boston this summer led to a new county detection.

## Spruce Budworm and Southern Pine Beetle Trapping

Spruce Budworm (SBW) trap catches are down from last year and remain at endemic levels. While we continue to see no signs of an outbreak anytime soon, Maine is anticipating major defoliation within a few years as the outbreak in Canada spreads southward. A task force of Maine forestry officials, academia at the University of Maine, and the Maine Forest Service are leading an effort to inform the public about the moth. A new website has just been launched as the primary clearinghouse for all things budworm.

<http://www.sprucebudwormmaine.org/>

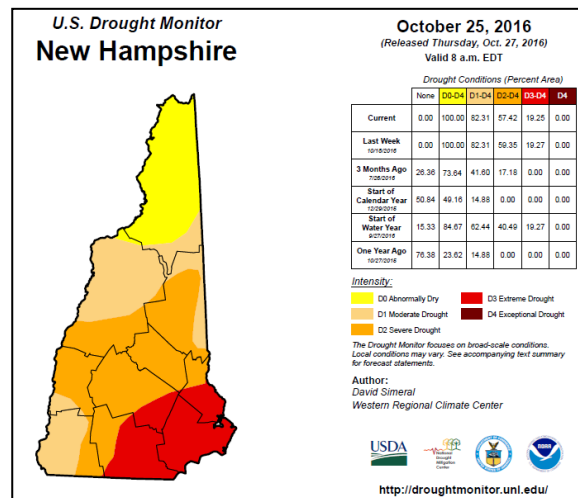
This was our second year trapping for Southern Pine Beetle (SPB) in response to the recent northern spread of the beetle. We added additional traps in the south western corner of the state in response to the detections in western Massachusetts last year. This year Massachusetts only had detections on the cape and coastal areas. We did not detect any SPB in our traps again this year.





## Drought

The weather for most of the state has been abnormally dry this year resulting in extreme drought conditions in some areas. Dry conditions led to an increase in brush fires, defoliation from caterpillars, and early leaf senescence. Fires crews were very busy battling fires on over 800 acres this year including a 300 acre fire in the White Mountain National Forest that was the largest to burn in this area in a century. The lack of rain also led to a decrease in fungal biological controls for defoliating caterpillars resulting in heavy defoliation in some areas. We had numerous reports of heavy gypsy moth in isolated areas of southeastern New Hampshire and forest tent caterpillar defoliated just over 9,000 acres in the White Mountain region. In addition, other native defoliators were in abundance throughout the state such as maple leafcutter, maple trumpet skeletonizer, and beech leaf-tier. The full effects of the drought conditions may not be seen for some time as stressed trees succumb to invasions from insects and pathogens that prey on stressed hosts.



## NH Aerial Survey Highlights for 2016

By: Jen Weimer

New Hampshire's annual aerial survey is a cooperative effort between the NH Division of Forests and Lands (NHDFL) and the USDA Forest Service Northeastern Area State and Private Forestry (USFS). The 2016 NH state aerial survey team mapped 6,339 acres of serious damage or defoliation on state and private lands and the USDA Forest Service mapped an additional 27,000 acres of damage on the White Mountain National Forest (WMNF).

The primary damaging causing agent this year was **needlecast diseases** on white pine which was mapped on almost 12,000 acres (NHDFL and USFS). Defoliation from **forest tent caterpillar** was also very heavy this year in the White Mountain regions of Coos, Carroll, and Grafton Counties with just over 9,000 acres mapped (NHDFL and USFS). In addition the NHDFL mapped 2,970 acres of **drought** induced discoloration of sugar maple, 854 acres of balsam fir mortality from **balsam woolly adelgid**, and 250 acres of mortality from **fire**. We also mapped **beech bark disease** (158 acres), **maple leaf cutter** (112 acres), **maple trumpet skeletonizer** (77 acres), **red turpentine beetles** (30 acres), **flooding** (27 acres), **logging damage** (24 acres), **ash yellows** (13 acres), **emerald ash borer** (8 acres), **brown spot needle blight** (6 acres), and **blue spruce needlecast** (2 acres).



# 2016 New Hampshire Forest Damage

## Primary Damage Causing Agent

- Sugar Maple Discoloration from Drought (2970 ac)
- Sugar Maple Defoliation from Forest Tent Caterpillar (1101 ac)
- Fir Mortality from Balsam Woolly Adelgid (854 ac)
- Discoloration from White Pine Needlecast (547 ac)
- Fire (259 ac)
- Beech Bark Disease Complex (158 ac)
- Wind-Tornado (156 ac)
- Sugar Maple Defoliation from Maple Leafcutter (112 ac)
- Sugar Maple Defoliation from Maple Trumpet Skeletonizer (77 ac)
- Red Pine Mortality from Red Turpentine Beetle (30 ac)
- Mortality from Flooding-High Water (27 ac)
- Dieback from Logging Damage (24 ac)
- Ash Dieback from Ash Yellows (13 ac)
- Ash Mortality from Emerald Ash Borer (8 ac)
- Brown Spot Needle Blight (6 ac)



State of New Hampshire  
Division of Forests & Lands  
Forest Health Program  
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Concord, NH 03302  
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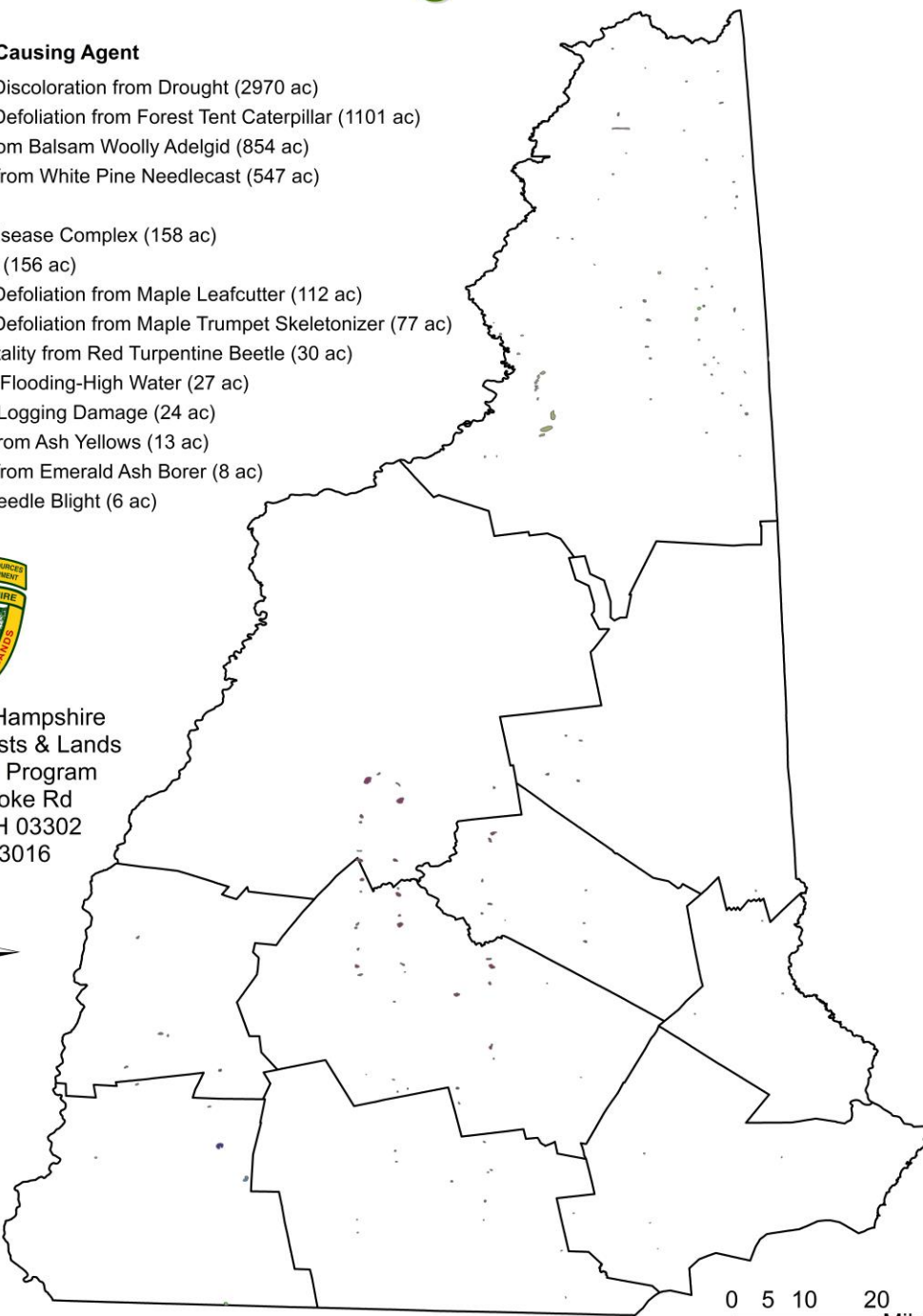


This map was created by Jon Weiner using  
aerial survey data from the NH Division of  
Forests & Lands Forest Health Program.  
This map represents areas of forest  
damage meeting minimum thresholds of  
severity and acreage.

15 November 2016



USDA Forest Service  
Northeastern Area



0 5 10 20  
Miles

## BUTTERNUT UPDATE

By: Kyle Lombard & Bruce Allen

2016 is the 20<sup>th</sup> anniversary of our butternut grafting project and we thought it would be a good time to take another look at the butternut trees in the program and report on their health. By 1996 butternut canker disease, *Ophiognomonia clavignenti-juglandacearum*, had spread throughout NH and heavy mortality rates were eliminating butternut everywhere. In 1996 with cooperative funding from the U.S Forest Service the Forest Health Program set out to find resistant butternut remaining in NH forests and create seed orchards from those healthy trees. Requests for help went out in several major newspapers and the response was amazing. People really love their butternuts. We visited 300 sites and looked at 3000 trees where folks thought they may have met our strict definition of a resistant tree. Of those 300 sites we found 20 sites that had a tree worthy of grafting scion material. Grafting was done at the State Forest Nursery in Boscaawen and grafted seed orchards were established at Caroline Fox Research and Demonstration Forest in Hillsboro and the State Nursery in Boscaawen.

Unfortunately, in 2015 surviving trees in both seed orchards were identified as Butternut x Japanese walnut (*Juglans ailantifolia*) hybrids. This realization prompted the need to visit each of the identified resistant trees and a re-examination to determine if they were truly native resistant butternut or butternut hybrids. Hybrids are much more resistant to the canker disease and technically not native.

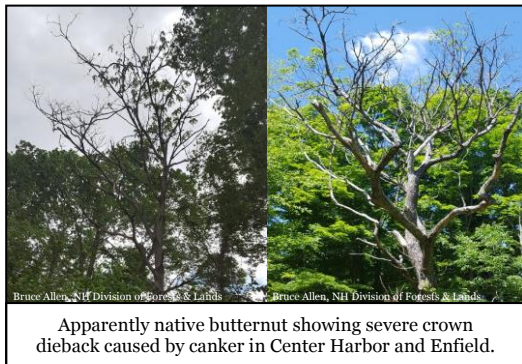
Identification of butternut and Japanese walnut x butternut hybrids is complicated by their ability to readily back cross with either parent species or other hybrids. Hybrids were first introduced into North America in the 1870's and were widely planted until the 1930's. Hybrids were more vigorous and produced more nuts than the native butternut. Morphological differences include pith color, lenticel shape, and difference in the leaf scar (Farlee et al. 2010). Back crosses to butternut in subsequent generations may minimize these differences.



Hybrid butternut in Portsmouth, NH

This past summer we visited the twenty original sites with superior butternuts and we had two goals: 1. Determine if superior trees continue to display canker resistance and 2.

To determine if trees identified in the 1990's as possibly canker resistant are truly butternut (*J. cinerea*) or are hybrids with Japanese butternut (*J. ailantifolia*).



Apparently native butternut showing severe crown dieback caused by canker in Center Harbor and Enfield.

At the original 20 sites we examined 74 butternut trees and using Farlee's key we estimated 39 of those 74 were hybrids. And just two of those 39 were considered "healthy" with less than 20% crown dieback. All the suspected hybrid trees had at least a few cankers of the disease on the

root flare or bole. The remaining 35 trees were determined to be native and all were moderately or heavily infected and dieback ranged from 20 to 80%. The healthiest native butternut was at the Rocks Estate owned by the Society for the Protection of New Hampshire's Forest in Bethlehem and the nicest hybrid butternut was an incredible specimen at the Rundlet-May House in Portsmouth.

Samples from 15 of the native and hybrid trees have been sent to Purdue University for DNA testing to verify our visual assessments. In the coming years we'll continue to look at potentially resistant trees as people report them. There are research organizations with breeding programs to back cross the resistance gene into native butternut. Maybe somebody in NH will stumble across a healthy native butternut that could be helpful.

Farlee, L., K. Woeste, M. Ostry, J. McKenna and S. Weeks. 2010. Identification of Butternuts and Butternut Hybrids. Purdue Extension FNR-420-W. 11 p.

## EAB UPDATE

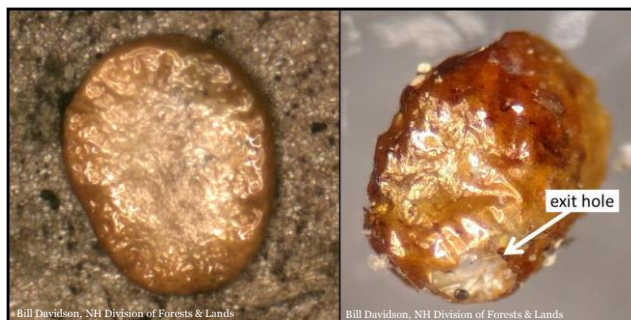
By: Bill Davidson

A variety of methods to detect emerald ash borer were used in 2016 which revealed several new infestations throughout the state. The New Hampshire Division of Forests and Lands along with the UNH Cooperative Extension set 103 EAB traps primarily within the Federal Quarantine, and USDA-APHIS-PPQ set 397 traps which were all outside of the quarantine. No emerald ash borer were captured on any of the traps outside of the quarantine, and five of the traps within the quarantine were positive for emerald ash borer. The positive traps ranged from 1 to 4 miles from known infestations and included the first infestations detected in the towns of Goffstown and Pittsfield. The other positive traps were in Dunbarton, Gilmanton, and Mont Vernon which were already known to be infested. Twenty trap trees were cut at 13 sites throughout the state with one new infestation found using this method at Alton Bay State Forest, 9 miles from the closest known infestation. The wasp *Cerceris fumipennis*, which captures beetles in the family that EAB belongs to (Buprestidae) and brings them to their nest to feed to their young, was used to make the first detection in Boscawen, and the first detections were made using visual surveys in Allenstown, Barnstead, Manchester, Pembroke, and Webster. Nine new towns were added in 2016 bringing the total to 25 with the core infested area spanning 30 miles long from Sanbornton to Goffstown and 20 miles wide from Webster to Pittsfield, with three smaller disjointed infestations in Alton, Mont Vernon, and Salem.

Biological control remains the most promising strategy for preserving ash in unaffected regions and protecting regenerating seedlings in areas that have already experienced high ash mortality. This year parasitoids were released in Concord, Hopkinton Northfield, Salem, and at two sites in Canterbury as part of the ongoing international



emerald ash borer biological control program. At each site two species of parasitic wasps were released weekly from June through September. Roughly 6,700 of the larval parasitoid (attacks EAB larvae) *Tetrastichus planipennisi* and 6,000 of the egg parasitoid (attacks EAB eggs) *Oobius agrili* were released per site totaling 77,000 parasitoids released in 2016. Three sites have received parasitoids in the past but have since been retired and at these sites three methods were used to evaluate establishment success of the parasitoids: rearing from infested logs, capture using traps, and inspection of EAB eggs on the trunks of ash trees. The first two methods were used to check for both parasitoid species while the third was used only for *Oobius agrili*. *Tetrastichus planipennisi* was recovered both by rearing and trapping and was recovered from all three sites, in one case ¼ mile from the release area. Trapping also yielded several native parasitoid species that are believed to be natural enemies of emerald ash borer, though conclusive identification of these species is pending. Evidence of parasitization by *Oobius agrili* was seen in EAB eggs from one site in Concord where 7 of 14 eggs recovered from the immediate release area showed signs of parasitization. Early results of the biological control program are encouraging with *Tetrastichus planipennisi* readily taking hold in all areas that have been evaluated so far, and although *Oobius agrili* has only been recovered from one site, its tiny size (<1mm) and cryptic nature of the eggs which it parasitizes make detection of this species considerably more difficult. The site in Concord along with one in Canterbury which were used for releases in 2016 were retired following the conclusion of this past field season and will now be evaluated for parasitoid establishment. New locations are being sought to replace them along the leading edge of the infested area with the goal of establishing populations of parasitoids throughout the emerald ash borer's range which will be able to grow and expand along with growing ash borer populations.



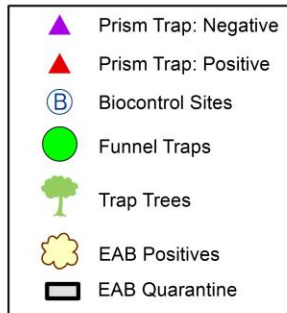
**EAB eggs:** Healthy EAB eggs (left) are filled with a sawdust-like frass when the beetle larva exits through the underside of the egg. Parasitized eggs (right) have a conspicuous exit-hole on the top side of the egg where *Oobius agrili* chewed its way out and contain black frass pellets known as the meconium left behind by the emergent wasp.



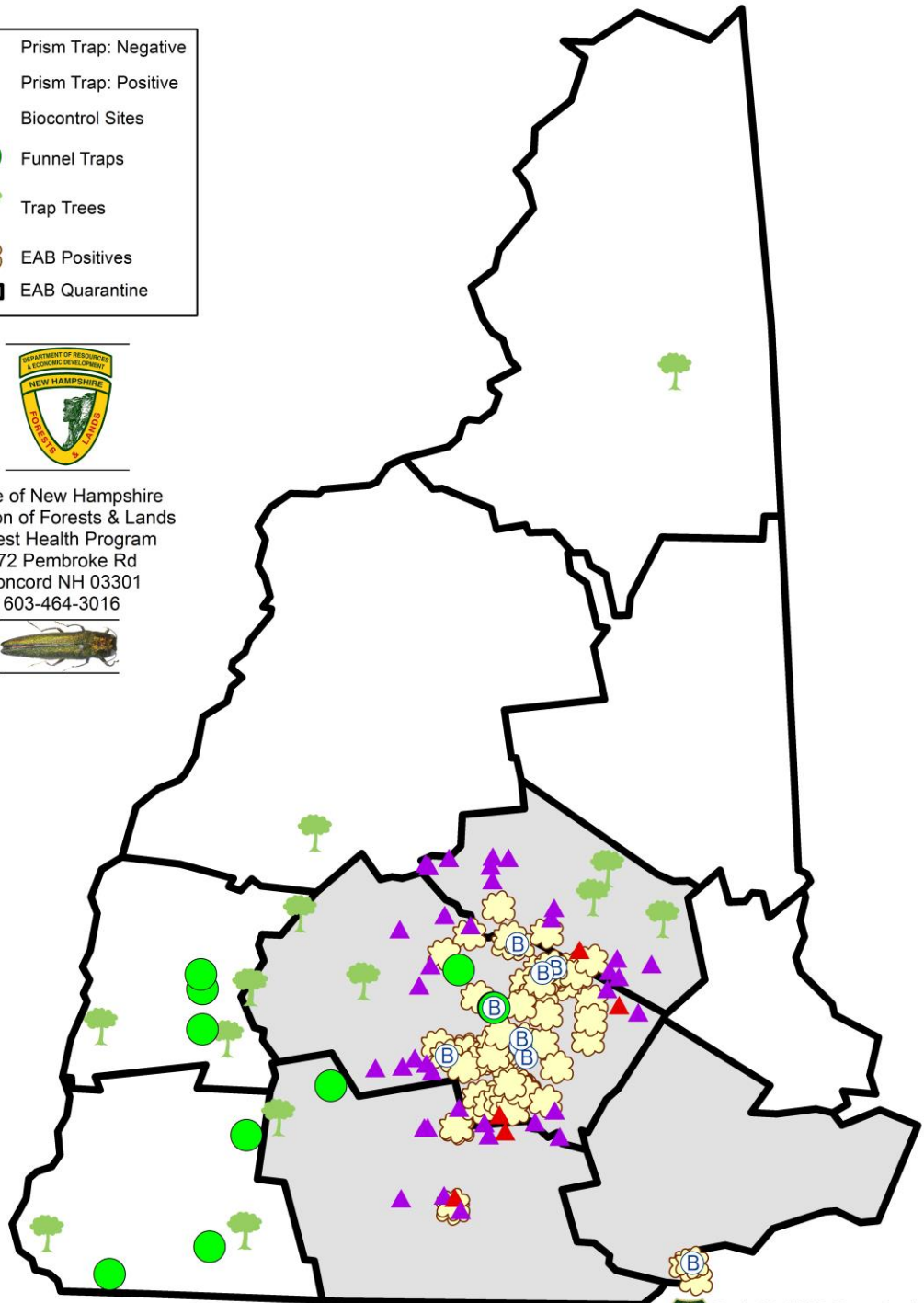
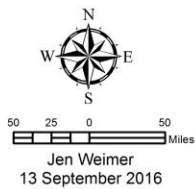
**Parasitized gallery:** Dozens of *Tetrastichus planipennisi* larvae pack this emerald ash borer gallery after they have consumed their host beetle larva.



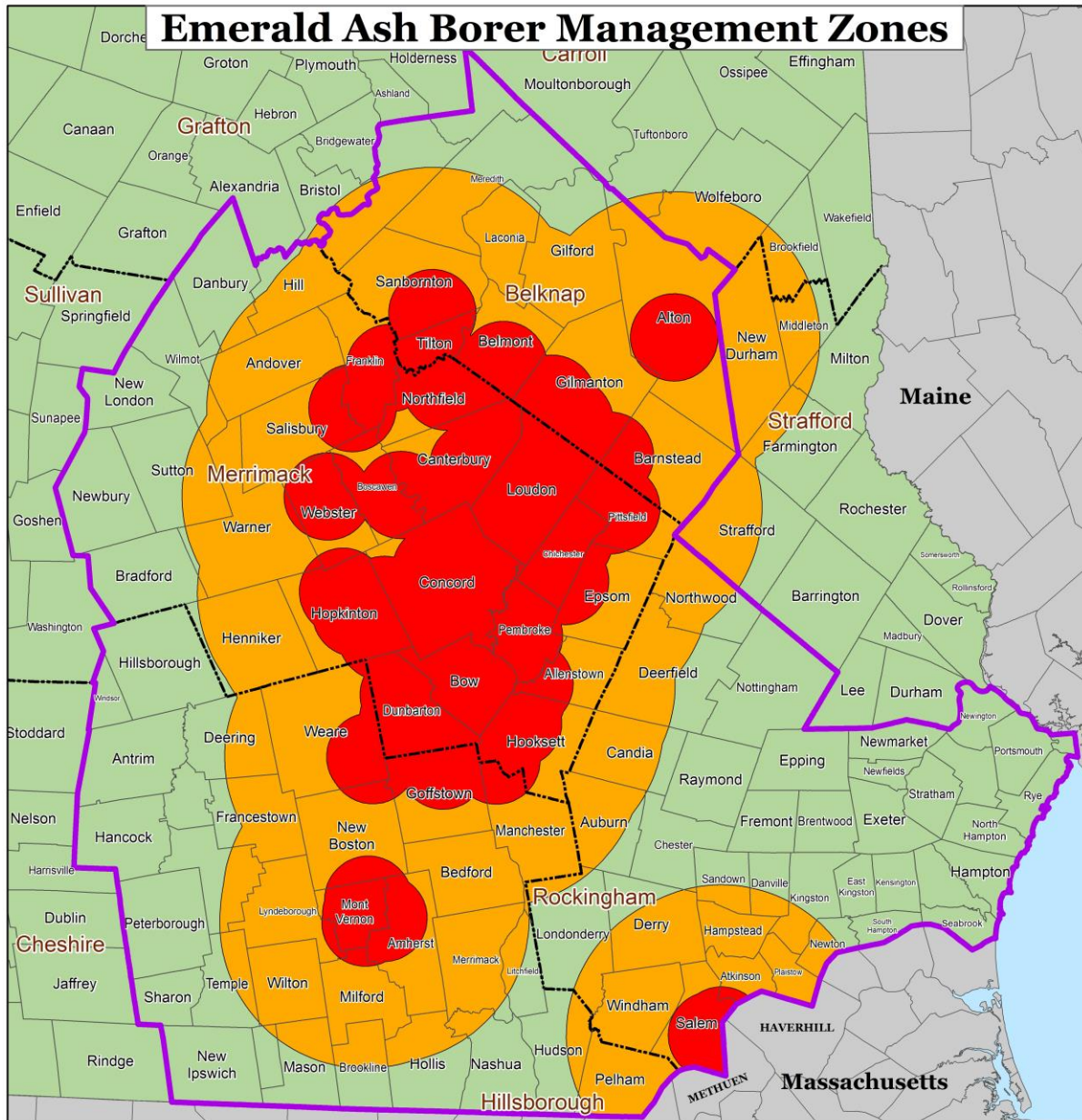
# 2016 Emerald Ash Borer Monitoring & Management



State of New Hampshire  
Division of Forests & Lands  
Forest Health Program  
172 Pembroke Rd  
Concord NH 03301  
603-464-3016



Funded by USDA Forest Service  
Northeastern Area



- EAB Generally Infested Area**
  - EAB Potential Expansion Area (10 Miles)**
  - EAB Alert Area (>10 Miles)**
  - Quarantine Area**
- 0 2.5 5 10  
 Miles  
 Date: 12/22/2016



**State of New Hampshire**  
**Department of Resources & Economic Development**



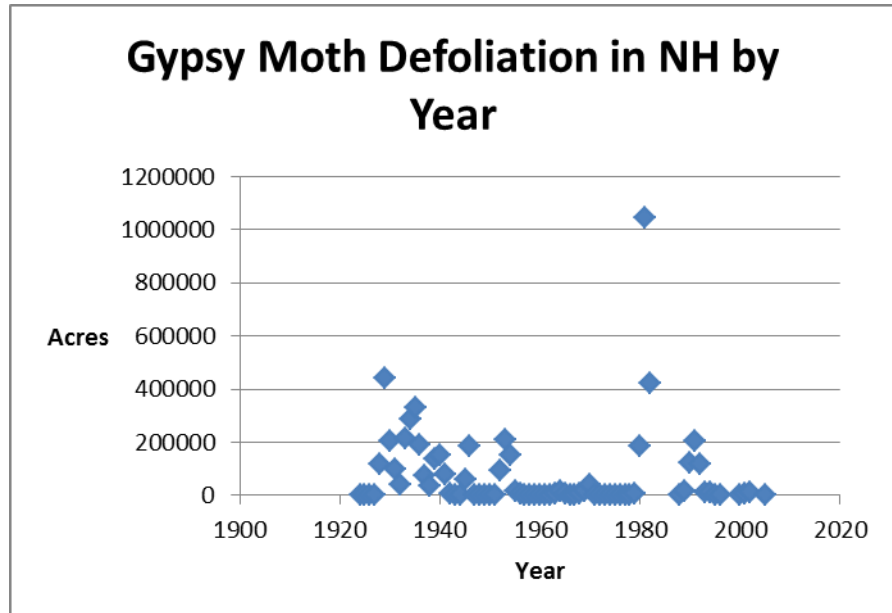
## FEATURE ARTICLE

By: Kyle Lombard

### Gypsy Moth Again?

I didn't think I'd be writing about gypsy moths again in my career, but here we go. Over a million acres of defoliation in southern New England and the mid-Atlantic states this year got our attention. Do you remember this pest? I think you do (if you're over a certain age). It's the caterpillar we all remember falling in our hair, squashing underfoot, and just being a general pain. It was ubiquitous in the 1980's. Remember the story regarding its origin? It was brought from Europe to Massachusetts by a guy that wanted to use it to breed a cold hardy silkworm for silk production in 1869. Somebody left his window open at the wrong time and "oops" it started one of the worst forest pest outbreaks in North American history. I'm going to give you my prediction for defoliation in 2017 but let's leave that for the end of this report. I'd like to take some time building the story.

Gypsy moth prefers oaks but will feed on virtually all hardwoods in New Hampshire and softwoods in the understory when no hardwood is left. The first recorded defoliation in NH was in 1924. From that point forward there was defoliation virtually every year until the early 1990's. The worst



defoliation ever recorded was in 1981 at just over a million acres. Gypsy moth caterpillars are hairy, with red and blue dots; they feed on leaves from late May to mid-July then pupate into adults. The adults mate in July and the females lay egg masses all over everything in July and August. The egg masses resemble clumps of tiny beads covered with reddish brown fur. The fuzzy fur that protects the eggs is actually stomach hair from the female moth which insulate the eggs overwinter. Healthy egg masses can be one to two inches long and contain 500 shiny little eggs.

So why after decades of continuous defoliation did the acres of damage tail off to nothing in the 90's? The answer is one of the great successes in insect pest Biocontrol. While there are many insect and mammal species that feed on gypsy moth there are two pathogens largely given credit for controlling gypsy moth populations in New





Hampshire. They are nucleopolyhedrosis virus (NPV) and *Entomophaga maimaiga* (*E. maimaiga* fungus). The NPV virus is a naturally occurring virus specific to each species of caterpillar. It's the insect's version of the flu. Unfortunately, the little critters have no immune system. The NPV specific to Gypsy moth is now common throughout NH and larvae killed by NPV tend to hang from trees in an upside down

"V" shape. The *E. maimaiga* fungus was imported in 1908 from Japan and attempts to spread the fungus continued until 1911. It wasn't until 1989 that an epizootic of this pathogen was discovered destroying large populations of gypsy moth in New England. From that point forward the fungus and virus have been common in our population and given credit for quickly suppressing any flare-ups of gypsy moth numbers.

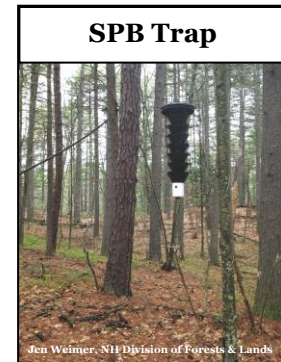
So what's going on this year with all the defoliation in southern New England and what's the prediction for next summer in New Hampshire? Well, likely what's going on is that we had an unfortunate timing of a drought when the gypsy moth population started to grow. The *E. Maimaiga* fungus needs regular spring and summer rains to be most effective and this past summer was anything but regular. We saw large increases in reports of scattered defoliated trees and a few hundred acres of defoliation in Rockingham County in 2016. Nothing compared to 400,000 in MA but definitely more than normal (since the early 1990's). So we've been doing egg mass counts at many of the old sites identified as locations where the gypsy moth traditionally started its population expansion at the beginning of each cycle. Counting the number of viable fresh egg masses can give you some idea about what level of defoliation you can expect the following summer. At all the sites in Merrimack and Hillsborough Counties we found nothing. In Rockingham County we found very few sites with egg masses except at one of the sites in Kingston which was loaded with healthy egg masses. Based on what we see out there right now I think we should expect an outbreak similar to what we saw in 2000-2005. It was centered in southern Rockingham County and went from two to eight to twelve thousand acres then back to two thousand and then was gone. We will continue to monitor the situation and give guidance to anyone that wants to do some of their own egg mass counts or mitigation. Please check in at our cooperative website on forest health at [nhbugs.org](http://nhbugs.org) for the latest updates and recommendations. This website is maintained by UNH Cooperative Extension. Many Agencies contribute to keeping this website current and it's definitely the best source of information around.

## FEATURE CREATURE

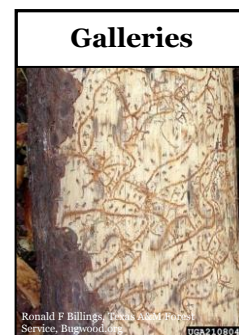
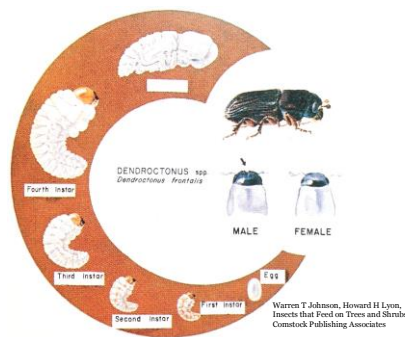
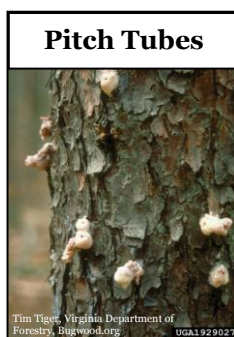
By: Jen Weimer

### Southern Pine Beetle (*Dendroctonus frontalis*)

Southern pine beetle (SPB) is considered the most economically important forest pest in the southern United States where it causes significant mortality of shortleaf, loblolly, Virginia, and pitch pines. In addition to southern pines, eastern white and red pines are also susceptible to SPB and spruce and hemlock may be attacked during outbreaks. While SPB is native to the south it has recently been expanding to the northeast as winter temperatures have been warming. In 2014 it was detected for the first time in New York on Long Island infesting pitch pine. Trapping surveys throughout New England in 2015 resulted in new detections in New York, Connecticut, Rhode Island, and Massachusetts. Traps deployed in New Hampshire in 2015 and 2016 did not detect any SPB. However, if the climate continues to warm we will most likely see this southern pest in our northern pine forests and plantations.

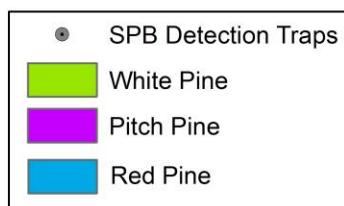


SPB is a small reddish-brown to black bark beetle that creates s-shaped tunnels just under the bark in the cambium tissue. As adult beetles chew their tunnels they inoculate the tree with blue stain fungi which penetrates the sapwood. Trees are killed within a few months once the tunnels and fungi disrupt the flow of nutrients. Trees respond to attack by secreting resin to pitch out adults but typically die when SPB populations are high. These pitch tubes resemble popcorn and can be used to aid in detection. SPB populations can remain at low levels for many years without tree mortality but eventually build to damaging levels in dense pine stands. SPB has numerous generations per year and overwinter in all life stages within the bark.



Managing healthy forests is the key to managing SPB. Female beetles are attracted to stressed trees and release aggregation pheromones which attract large numbers of males for mating. Males also release pheromones that attract even more beetles resulting in epidemic levels that are lethal to the tree. Thinning reduces competition among trees and increases distance between trees which makes it more difficult for beetles to communicate using pheromones. Cutting infested trees in the winter also reduces overwintering populations. You can help by reporting trees with signs of infestation.

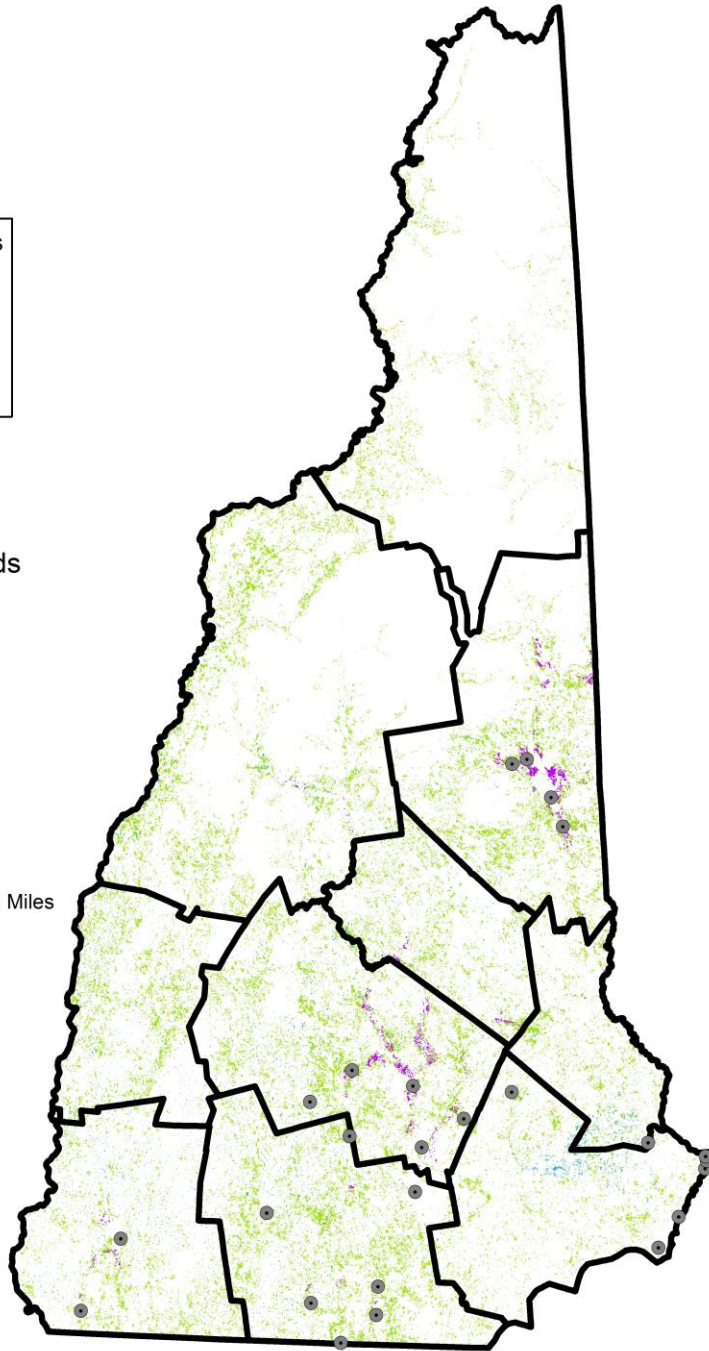
# Pine at Risk to Southern Pine Beetle Infestation



New Hampshire  
Division of Forests & Lands  
Forest Health Program  
172 Pembroke Rd  
Concord NH 03301



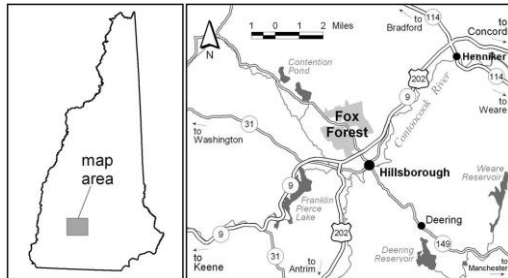
0 10 20 40 Miles



Host Type Data from Complex Systems  
Research Center, University of New Hampshire



# Office Notes



The NH Forest Health Program office and lab is located at the Caroline A. Fox Research and Demonstration Forest in Hillsboro. Our small staff monitors the condition of New Hampshire's 4.8 million acres of forest. You can help by contacting us if you observe any forest damage. Photos can be uploaded at [NH Bugs.org](http://NH Bugs.org) or you can contact us for a site visit. You can also follow us on social media

to keep up to date on forest health issues. This year we reached 9,006 on [Facebook](https://www.facebook.com/NHDFL) and 29,385 on [Twitter](https://twitter.com/NHDFL)! Thanks for all the likes and retweets! In addition we email quarterly updates in March, June, and September. If you're not already on the mailing list you can sign up on our [website](http://NH Bugs.org) or [Facebook](https://www.facebook.com/NHDFL) page.

We are excited to announce a new online tool that can be used to map exotic pests in New Hampshire with forest management implications. The site is designed to be utilized by landowners, state agencies, and land managers to determine where exotic pests are within the state in order to make management decisions and comply with state quarantines. In addition to the interactive map the site includes pdf printable maps, quarantine info, and fact sheets. Check it out and let us know what you think!



**NEW! Check out our new online interactive mapping of exotic pests with forest management implications.**

## Recent Research Publications:

### Soil and Stocking Effects on Caliciopsis Canker of *Pinus strobus* L.

Munck, I.A.; Luther, T.; Wyka, S.; Keirstead, D.; McCracken, K.; Ostrofsky, W.; Searles, W.; Lombard, K.; Weimer, J.; Allen, B. Soil and Stocking Effects on Caliciopsis Canker of *Pinus strobus* L.. *Forests* **2016**, 7, 269.

## Forest Health Program Contacts

Program Coordinator	Forest Health Specialist	Forest Health Specialist-EAB
Kyle Lombard	Jen Weimer	Bill Davidson
603-464-3016 x101	603-464-3016 x102	603-464-3016 x103
<a href="mailto:Kyle.Lombard@dred.nh.gov">Kyle.Lombard@dred.nh.gov</a>	<a href="mailto:Jennifer.Weimer@dred.nh.gov">Jennifer.Weimer@dred.nh.gov</a>	<a href="mailto:William.Davidson@dred.nh.gov">William.Davidson@dred.nh.gov</a>



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